2024

CAAS ANNUAL REPORT

Compiled by the
Department of International Cooperation of CAAS

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Department of International Cooperation
Chinese Academy of Agricultural Sciences

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EDITORIAL BOARD

Message from the President

The year 2024 marked a pivotal stride in China's journey toward high-level self-reliance and strength in agricultural science and technology. Under the guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, and in earnest implementation of the strategic decisions of the CPC Central Committee, the State Council and the Ministry of Agriculture and Rural Affairs, the Chinese Academy of Agricultural Sciences (CAAS) remained steadfast in addressing national priorities, fortifying foundational capabilities, advancing institutional reform, and driving high-quality development across all fronts. These efforts underpinned China's historic grain output surpassing 700 million tons, supported solid progress in rural revitalization, and laid a strong foundation for building an agricultural power.

Throughout the year, CAAS comprehensively strengthened efforts in organized scientific research, improving its overall innovation performance of its innovation system, and achieving major advances in key domains. CAAS improved its capacity for basic research, bolstered efforts to ensure stable agricultural production and supply, and delivered stronger support for rural revitalization. International engagement was deepened, and high-quality development yielded notable outcomes. By leveraging the national key laboratories, CAAS established a coordinated system for fundamental research, establishing 11 interdisciplinary Fundamental Science Research Centers focused on frontier challenges. Ten major scientific tasks were launched, including the productivity enhancement initiative for staple crops. New crop varieties, such as the high-yield, high-oil Zhongdou 51 soybean, salt-tolerant Hangmai 802 wheat and Zhongyou 351 rapeseed, and low-cadmium Anliangyou No. 2 rice, were bred. Breakthroughs were achieved in nitrogen-fixation coupling technology, while the ARC microbial inoculant was applied across 230 demonstration sites in 17 provinces, boosting soybean yields by 15.1% and peanut yields by 19.5%. CAAS scientists made globally leading breakthroughs, including the first resolution of the fine structure of insect olfactory receptors and the discovery of how insect transporter proteins carry exogenous insecticidal substrates. CAAS secured 41 new projects under the National Key R&D Program and 368 new grants from the National Natural Science Foundation of China—a 22.6% increase in direct funding—covering Basic Science Centers, Distinguished Young Scholars, and Major National Priorities. On the global stage, CAAS took the lead in agricultural science cooperation within the G20, APEC, and other bilateral and multilateral mechanisms. CAAS actively contributed to international negotiations and rule-making dialogues, spearheaded the Three-Year Action Plan for Belt and Road Science and Technology for Poverty Reduction Initiative, and won the 2024 FAO Achievement Award for the regional Fall Armyworm control strategy—an exemplar of China's contribution to global agricultural governance.

As we enter 2025, the final year of the 14th Five-Year Plan and the starting point for the 15th, CAAS will remain true to its mission as the national agricultural research institution. Guided by the "Four Orientations", CAAS will further deepen reform, deliver the new nationwide system for innovation, refine and elevate the Agricultural S&T Innovation Program, and improve the efficiency of the innovation ecosystem. With these continued efforts, CAAS will contribute more profoundly to rural revitalization and to building up China's strength in agriculture, laying a solid foundation for the next stage of high-quality development in the new era.

Prof. Wu Kongming
President of Chinese Academy of Agricultural Sciences

COMMITMENT

As a national agricultural research institution, CAAS is the highest academic institution for comprehensive agricultural research in China, serving as a strategic consultancy for agricultural science and technology, and is a national strategic force in the field of agriculture, rural areas, and farmers. CAAS consistently fulfills its mission, utilizing its position as a strategic scientific force, and fully implementing major works regarding agriculture, rural areas, and scientific innovation. It focuses on the forefront of global agricultural science and technology, addressing national needs, promoting modern agriculture, and contributing to people's health and well-being. CAAS is dedicated to solving major scientific and technological challenges in China's agricultural and rural economic development. CAAS aims to establish national centers for agricultural science and technology innovation, technology transfer, talent development, cooperation, and high-level think tanks. These efforts contribute significantly to ensuring national food security, advancing rural revitalization, and leading agricultural modernization.

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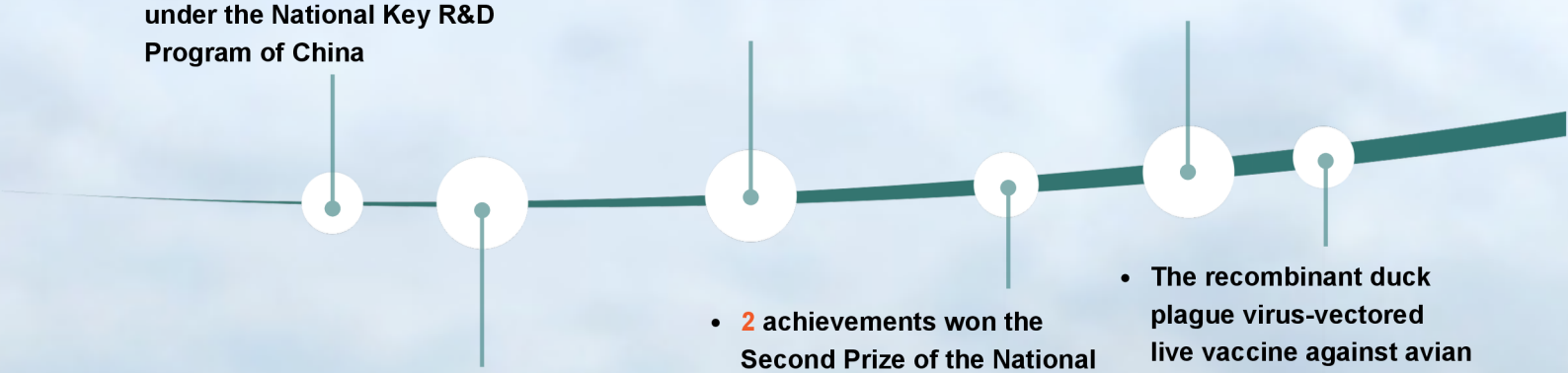
2024 ANNUAL REVIEW

2024 in Numbers

- 368 new projects were approved by the National Natural Science Foundation of China (NSFC)
- 41 projects were approved under the National Key R&D Program of China

- 139,000 new accessions of germplasm resources were collected, including 746 endangered accessions
- Over 580,000 germplasm resources preserved long-term

- 2 technologies were selected as 2024 National Leading Agricultural Technologies; 18 dominant varieties and 24 key technologies were widely promoted
- 18 expert groups deployed 48 technical task forces, totaling nearly 2,000 person-times across 28 provinces, and delivered over 1,000 training sessions



- 4,910 articles were published in SCI/EI-indexed journals, marking a 4.9% year-on-year increase
- 8 papers were published in *Nature*, *Science*, and *Cell* journals with CAAS as the first author affiliation

- 2 achievements won the Second Prize of the National Science and Technology Progress Award and the National Technology Invention Award
- 28 provincial and ministerial awards were received, including 9 first prizes

- The recombinant duck plague virus-vectored live vaccine against avian influenza was granted a Class I New Veterinary Drug Certificate

- Total budgets over RMB 4 billion (+7% YoY)
- RMB 1.05 billion invested in facility construction
- 3 national key laboratories were co-established

- A comprehensive observational system for long-term factors was established, comprising 17 observation stations, 1 central data hub, and 4 data service nodes
- Long-term foundational and expansion experiments were conducted for 6 crop categories
- 670,000 basic observation records were collected

- 55 high-level talents were recruited, including 1 Academician from the African Academy of Sciences
- 1 Distinguished Young Scholar
- 6 national-level young talents
- 3 scientists received the Guanghua Engineering Science and Technology Award, the Ho Leung Ho Lee S&T Award, and the Science Exploration Award, respectively
- 446 staff were promoted to senior professional titles
- 37 scientists were added to the Agricultural Science Talents pool, totaling 477

- CAAS received 5 head-of-state level and 32 ministerial-level foreign delegations
- 4 achievements were selected as Best Practices in the Fifth Global Poverty Reduction Award
- 1 research achievement received the 2024 FAO Achievement Award

- 10 major R&D missions were launched
- 3 new expert groups were established
- A coordinated technical service system was developed centered on 18 existing expert groups

SCIENCE AND TECHNOLOGY INNOVATION

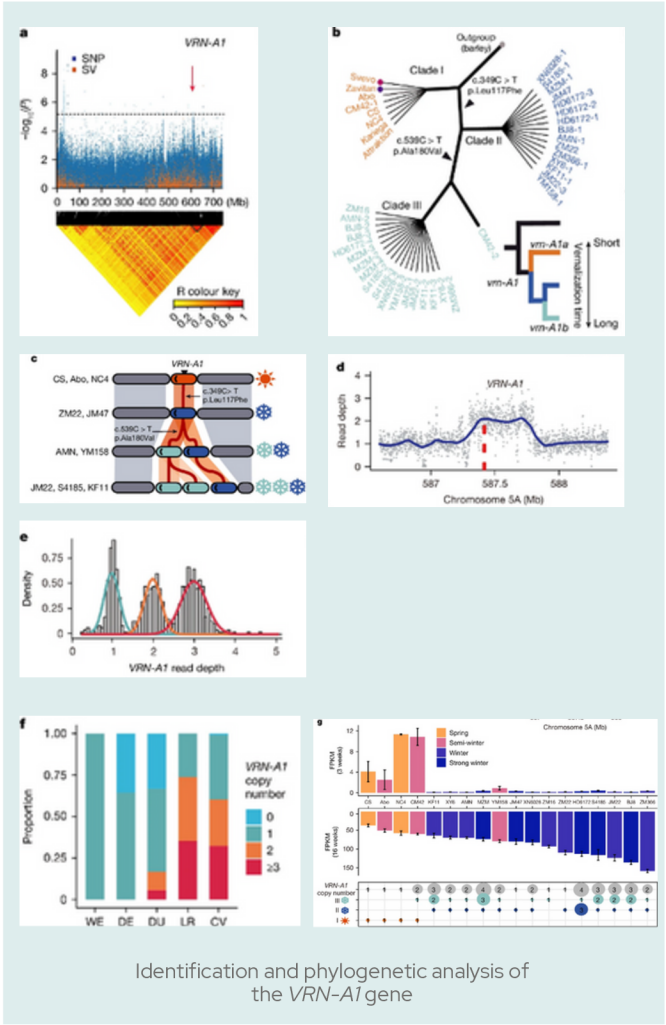
- Major Scientific Discoveries
- Major Product Developments, Technological Breakthroughs, and Think Tank Reports
- Major Technological Tasks

01. Major Scientific Discoveries

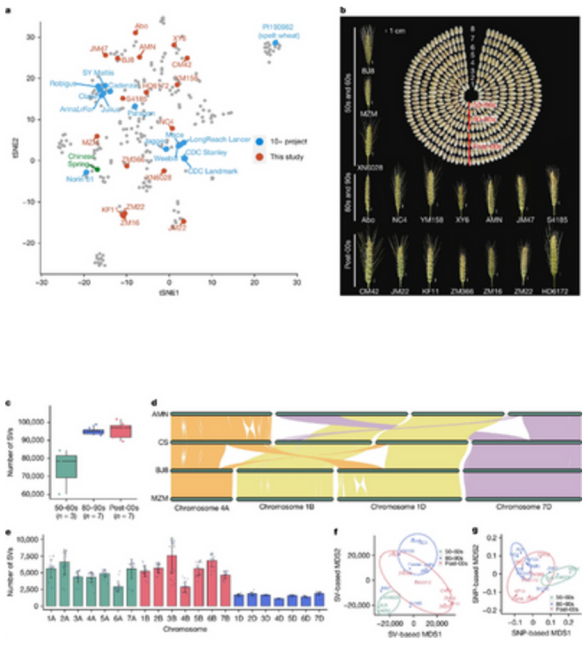
Crop pan-genome reveals that structural variations drive adaptive evolution and breeding improvement of varieties

Institute of Crop Sciences; Jiao Chengzhi, first author; Zhang Xueyong, corresponding author

This study performed chromosome-level de novo assembly of 17 representative wheat cultivars with high-quality genomes, uncovering how structural variations influence wheat adaptability and breeding. The results provide valuable genomic resources, novel perspectives, and strategic approaches to support future wheat breeding efforts.



Identification and phylogenetic analysis of the *VRN-A1* gene

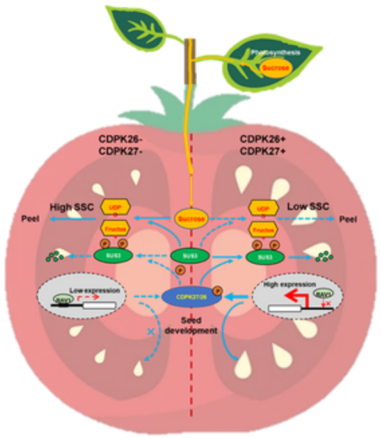


Genome assemblies and spike/grain phenotypes of 17 representative wheat varieties

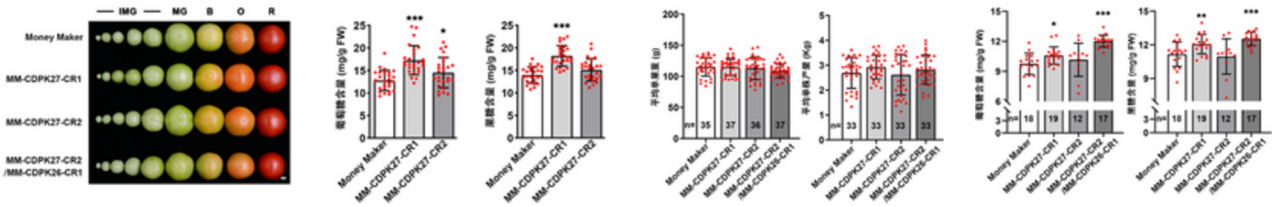
Releasing “sugar-brake” genes to create high-sugar tomatoes

Institute of Vegetables and Flowers; Zhang Jinzhe, first author; Huang Sanwen, corresponding author

This study identified two “brake” genes, *CDPK27* and *CDPK26*, that suppress sugar accumulation in tomatoes. By releasing these genes, the research successfully overcame the long-standing challenge of balancing fruit quality and yield in tomato breeding. The study was hailed in a Nature News & Views commentary as “a model for tomato improvement and an exciting step toward understanding fruit energy allocation”. The findings were widely covered by major media outlets including The Guardian, New Scientist, and The Wall Street Journal.

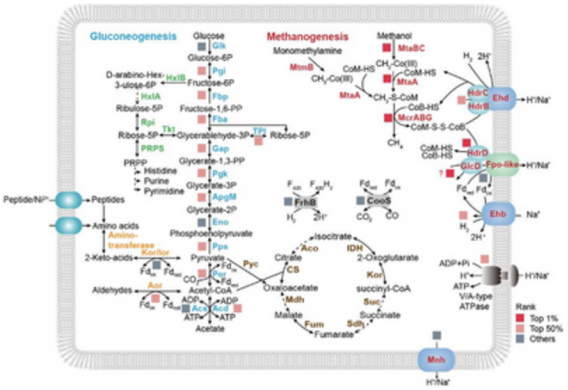


Regulatory role of *CDPK27*, a “Sugar Brake” gene, in fruit sugar metabolism



CDPK27 and *CDPK26* suppress sugar accumulation in fruit

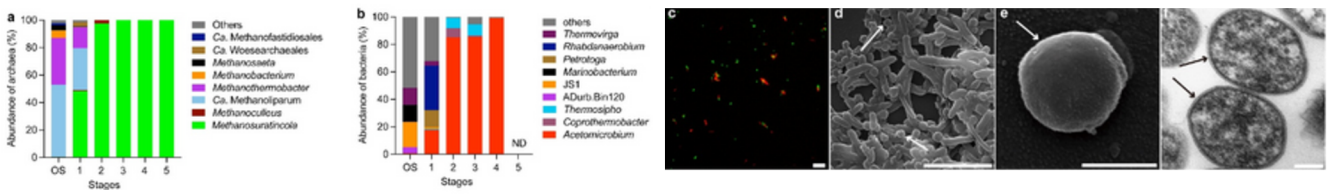
Isolation of a non-Euryarchaeota methylotrophic methanogenic archaeon



Archaeal and bacterial composition and abundance during the isolation of Methanosarcinatia Archaea

Biogas Institute of Ministry of Agriculture and Rural Affairs; Wu Kejia, first author; Cheng Lei, corresponding author

This study successfully isolated the first pure culture of a non-Euryarchaeota methanogenic archaeon belonging to Verstraetearchaeota. The strain was confirmed to exhibit methylotrophic methanogenesis while lacking fermentative growth capacity. The discovery expands our understanding of archaeal biodiversity and provides important insights into the global carbon cycle and low-carbon biotechnologies. The study was published in *Nature* on August 24, 2024, and has been cited 8 times to date.

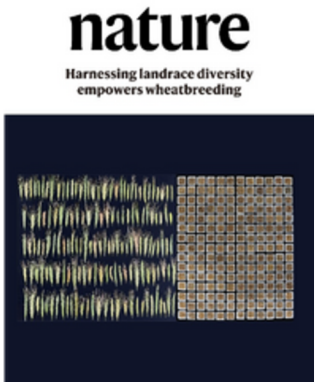


Genome-guided metabolic pathway reconstruction of strain LWZ-6

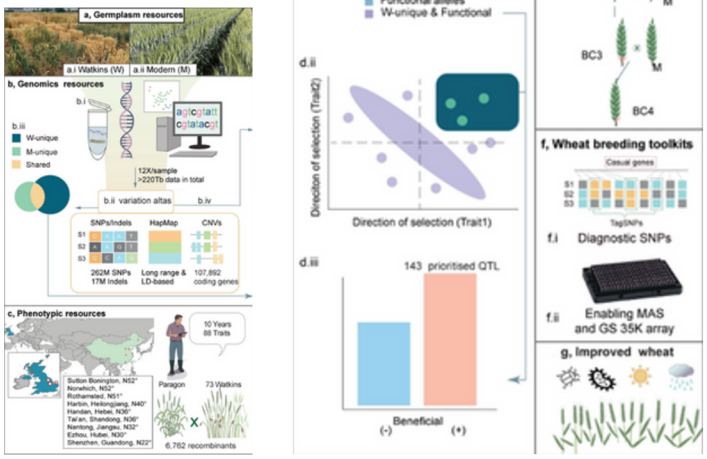
Harnessing global landrace diversity to empower new breakthroughs in wheat design breeding

Agricultural Genomics Institute at Shenzhen; Cheng Shifeng, first author and corresponding author

This study introduced 1,047 wheat landrace accessions collected over a century ago from multiple countries worldwide, aiming to unlock the lost genetic diversity hidden in modern wheat cultivars. The research successfully developed a new strategy for genome-based wheat design breeding, marking a breakthrough in leveraging ancient genetic resources for modern applications. The findings were published in *Nature*, and received high acclaim in expert commentaries featured in *Science, Nature Plants,* and *Molecular Plant*.



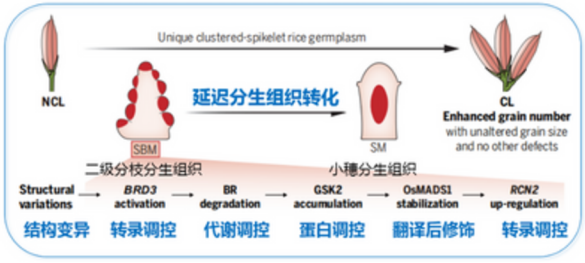
Local variety diversity empowers wheat breeding



End-to-end 4D strategy enables genome-based breeding by design

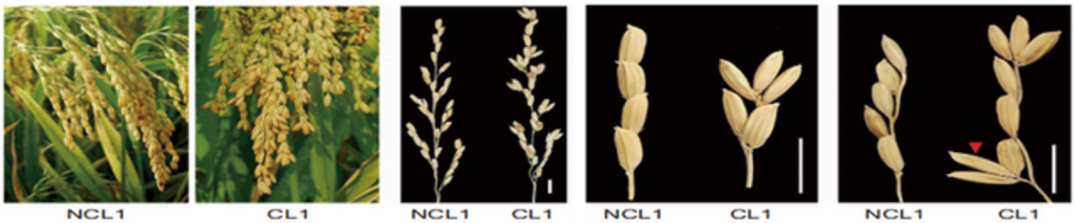
Tissue-specific suppression of brassinosteroid signaling increases rice panicle branching and grain yield

Institute of Crop Sciences; Zhang Xiaoxing, first author; Tong Hongning, corresponding author



Tissue-specific molecular pathways of BR-mediated regulation of grain number per panicle in rice

This study deciphered the genetic basis of clustered spikelets in elite germplasm and revealed a new hormonal mechanism regulating spikelet number. By overcoming the negative correlation between grain number and grain weight, it provides a new technological pathway to boost grain yield. The paper was highly regarded by international experts and covered by international journals, has been listed as a highly cited publication.



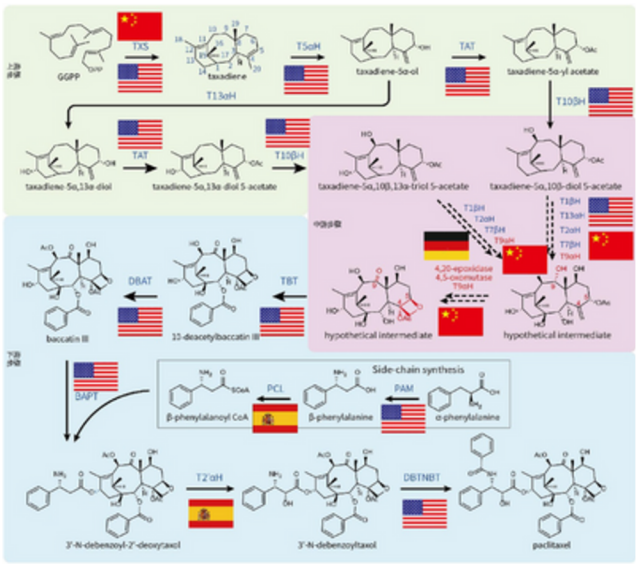
Panicle branching characteristics of the super-grain rice line CL1

Identification and heterologous reconstitution of the taxol precursor baccatin III biosynthetic enzymes

Agricultural Genomics Institute at Shenzhen; Jiang Bin, first author; Yan Jianbin, corresponding author

Taxol is a natural broad-spectrum anti-cancer agent. This study identified long-missing enzyme in the taxadiene biosynthetic pathway and successfully achieved its heterologous reconstitution, marking a major breakthrough in addressing a long-standing scientific challenge in plant natural product biosynthesi. The work has been recognized as a model of "strengthening basic research and cultivating new quality productive forces".

Taxus, known as the Giant Panda of the plant world

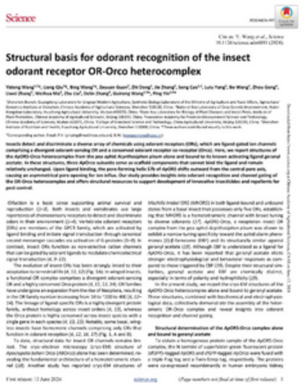


Biosynthetic pathway of Paclitaxel III

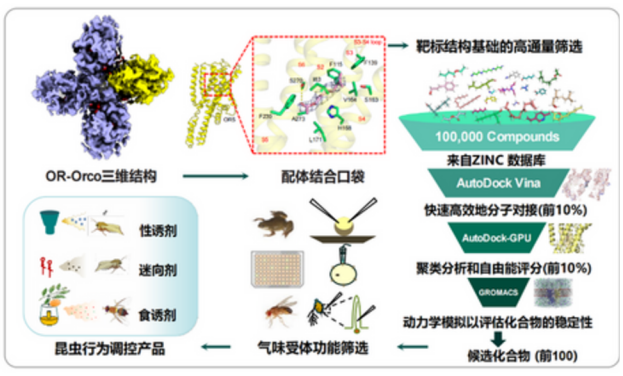
The cryo-EM structure and mechanism of insect odorant receptor complex

Agricultural Genomics Institute at Shenzhen; Wang Yidong, first author; Wang Guirong, corresponding author

This study was the first worldwide to resolve the cryo-EM structure and molecular mechanism of the insect odorant receptor complex. The newly identified target provides a theoretical foundation for the development of green pest control strategies with novel modes of action. Academicians praised the work as a milestone enhancing China's core competitiveness in insect behavior regulation. The research was covered over 20 times by national media, including *People's Daily* and *Xinhua News*.



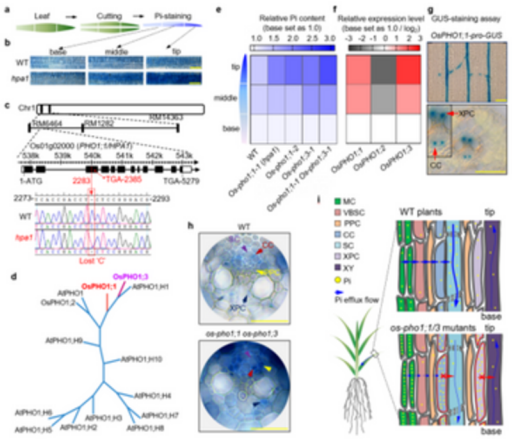
Mechanistic elucidation of Ion channel gating in insect olfactory receptors



Development of behavior-modulating products targeting olfactory receptor structures

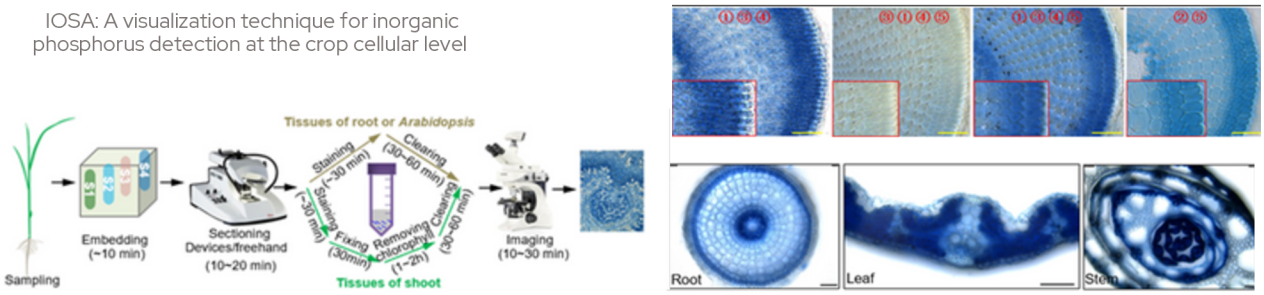
Visualization of inorganic phosphate distribution in plant cells

Institute of Agricultural Resources and Regional Planning; Guo Meina, first author; Yi Keke, corresponding author



This technique enhances resolution to the micron level—tenfold faster and nearly 100-fold cheaper than current leading in situ phosphorus detection methods. Utilizing the IOSA technology, researchers revealed for the first time the inorganic phosphate distribution pattern in rice cells, discovered new functions of core phosphate regulators, and identified new genes contributing to phosphorus use efficiency. The study provides new approaches for mechanistic studies and genetic improvement of phosphorus-efficient crops.

IOSA: A visualization technique for inorganic phosphorus detection at the crop cellular level

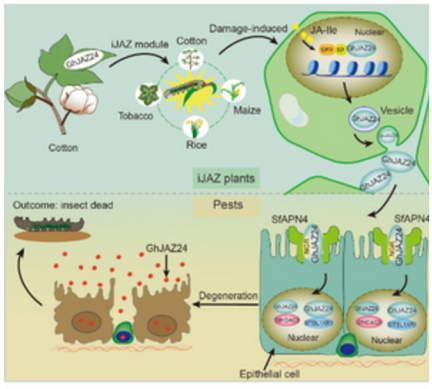


Identification and screening of novel genes involved in efficient phosphorus regulation using IOSA

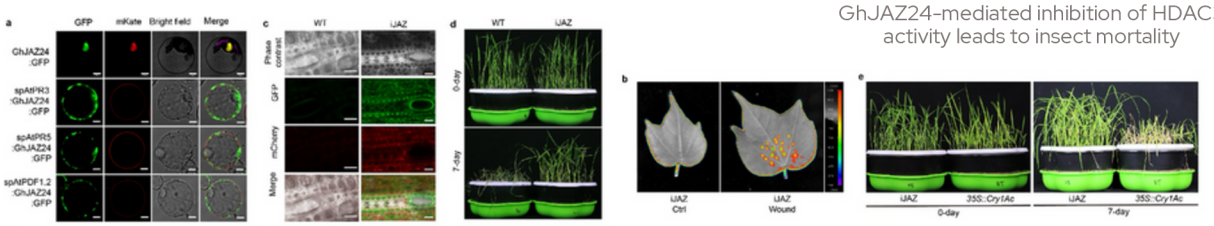
An iJAZ-based engineering approach for multiple crop resistance against lepidopteran pests

Institute of Cotton Research; Mo Huijuan, first author; Li Fuguang, corresponding author

After years of research, the team identified an insecticidal protein GhJAZ24 from cotton and designed an inducible secretion expression vector iJAZ. Crops expressing iJAZ showed broad-spectrum resistance to major lepidopteran pests including *Spodoptera frugiperda*, *Helicoverpa armigera*, and *Ostrinia furnacalis*. The resistance of iJAZ-rice to *Helicoverpa armigera* was experimentally validated by the Institute of Plant Protection, CAAS. The study was highlighted by *Science China*: *Life Sciences* and *Trends in Plant Science*.



GhJAZ24-mediated inhibition of HDAC3 activity leads to insect mortality

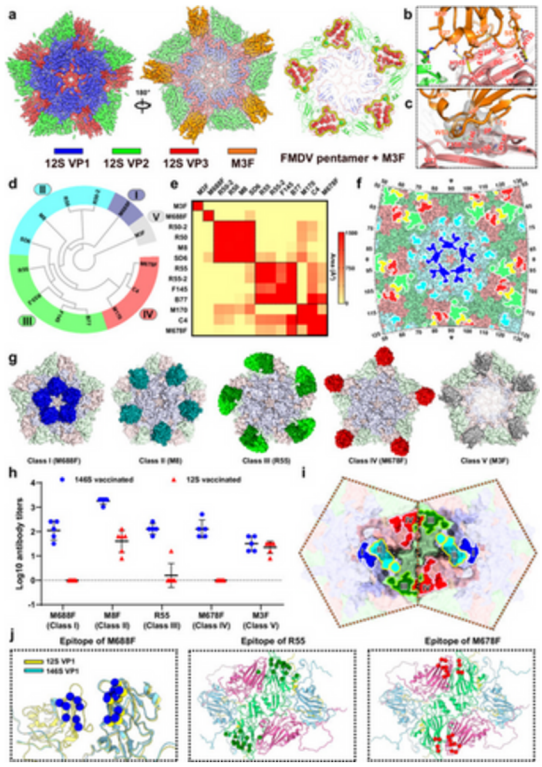


Discovery and functional characterization of the novel insect-resistance gene *GhJAZ24* in cotton

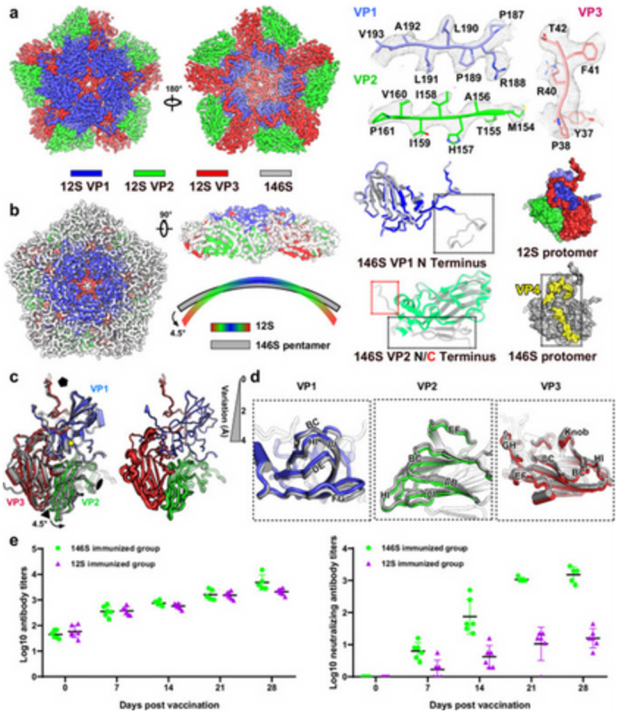
Structural basis for reduced antigenicity and immunogenicity of foot-and-mouth disease virus

Lanzhou Veterinary Research Institute; Li Haozhou, first author; Sun Shiqi, corresponding author

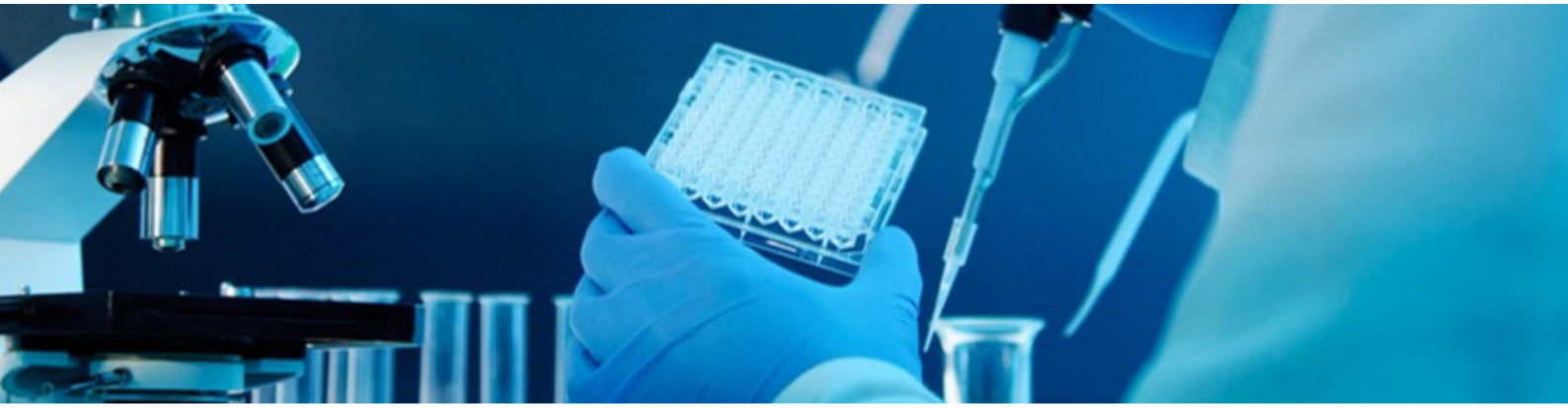
This study reported for the first time the high-resolution structure of 12S pentamers of a small RNA virus. It revealed that disassembly of the 146S antigen leads to conformational alterations on the pentamer surface, explaining reduced protective efficacy post-vaccine degradation. The findings provide critical structural insights for the rational design of novel multivalent and broad-spectrum FMD vaccines.



Structural landscape and classification of FMDV antibodies



Cryo-EM structure of the dissociated pentamer of FMDV



02. Major Product Developments, Technological Breakthroughs, and Think Tank Reports

Zhongnong Cuiyu No. 3: a new functional low-fat cucumber variety

【Led by Zhang Shengping, Institute of Vegetables and Flowers】

The team developed Zhongnong Cuiyu No. 3, the first functional low-fat cucumber variety, opening a new direction in the breeding of high-quality functional cucumbers. This variety significantly improves disease and stress resistance and enhances the commercial quality of white-skinned cucumbers grown in protected cultivation environments. Rich in tricarboxylic acid (TCA) derivatives such as tricarballylic acid, Zhongnong Cuiyu No. 3 can inhibit the conversion of sugars into fat, thus offering a fat-reducing function. It is a female-line, parthenocarpic variety with strong disease resistance, suitable for cultivation in greenhouses and trellis cultivation nationwide. The variety has received a Plant Variety Right Certificate and a Non-major Crop Variety Registration Certificate, with full independent intellectual property rights. As a premium vegetable variety well-suited for supply to large supermarket chains, it commands a high market price, significantly increasing growers' income. The variety has been extensively promoted across multiple provinces, achieving record-breaking transfer value among cucumber varieties in China. It has received multiple awards and was selected as one of the 2024 Major Scientific and Technological Achievements in Agriculture and Rural Affairs – New Product Category.

Commercialized Zhongnong Cuiyu No. 3 cucumber

Development and industrial application of herbicide-tolerant cotton GGK2

【Led by Guo Sandui and Liang Chengzhen, Biotechnology Research Institute】

The research team developed the herbicide-tolerant cotton line GGK2 by stacking two proprietary genes—*GR79 EPSPS* and *GAT*. The resulting cotton varieties exhibit strong tolerance to glyphosate at concentrations more than four times higher than standard production use, with low residue levels 15 days after application and excellent weed control performance. In January 2024, GGK2 received China's first Agricultural GMO Safety Certificate for genetically modified herbicide-tolerant cotton. A rapid test strip for GGK2-specific identification was also developed. The germplasm has been distributed to multiple cotton seed companies and research institutions, with over 100 leading cotton varieties in China's three major cotton regions already carrying the trait, laying a solid foundation for industrial application of biobreeding in cotton.

Field application effect of glyphosate on GGK2 cotton

中华人民共和国
农业转基因生物安全证书（生产应用）

Safety Production Certificate for herbicide-tolerant cotton GGK2

Recombinant duck plague virus-vectored live vaccine against avian influenza

【Led by Chen Hualan, Harbin Veterinary Research Institute】

After 17 years of dedicated research, the team developed a recombinant duck plague virus-vectored live vaccine capable of preventing both H5 avian influenza and duck plague—achieving "two diseases, one shot" for the first time in the world. On March 26, 2024, it was granted a New Class I Veterinary Drug Registration Certificate. The vaccine provides rapid onset and long-lasting protection, significantly improving H5 AI immunization coverage in duck populations. It offers crucial support for effective avian influenza control in China and Southeast Asia and represents a major step toward eliminating the H5 subtype in the long term.

Live attenuated vaccine against Avian Influenza based on recombinant Duck Plague virus vector

New Class I Veterinary Drug Registration Certificate for the recombinant Duck Plague virus-vectored live vaccine against Avian Influenza

Jizuo Black Raccoon Dog: a new animal breed

【Led by Xu Chao, Institute of Special Animal and Plant Sciences】

The Jizuo Black Raccoon Dog, developed under the leadership of the Institute of Special Animal and Plant Sciences, was approved as a new livestock and poultry breed (supporting line) by the National Committee for Animal Genetic Resources in December 2023. It is the world's first independently bred black raccoon dog variety. Initiated in 2011, the breeding process involved the creation of black raccoon dog germplasm, followed by crossbreeding, coat color purification, and trait stabilization over 12 years. The breed enriches natural-color fur types, reduces environmental impact, enhances international competitiveness, and represents a strategic breakthrough for China's fur animal industry.

New variety certificate for Jizuo Black Raccoon Dog

Jizuo Black Raccoon Dog

Regional integrated control technology for wheat stripe rust

【Led by Chen Wanquan, Institute of Plant Protection】

Facing frequent and severe outbreaks of wheat stripe rust in China, the team conducted long-term, systematic studies to develop a comprehensive prevention strategy. They accurately delineated the pathogen source areas, clarified spore transmission patterns, and established inter-regional monitoring technologies. The study also revealed virulence evolution and resistance breakdown mechanisms, and formulated region-specific control strategies and countermeasures. A complete integrated control system was established, supported by multiple monographs, scientific papers, and technical standards. It has served as the scientific basis for policy documents by the Ministry of Agriculture and Rural Affairs. The technology has been widely applied in China's northwest and southwest rust source areas for over a decade, significantly reducing epidemic frequency and losses in the main wheat-producing regions. It was selected as one of the 2024 National Leading Agricultural Technologies.

Integrated Management Technology System for Spring Inoculum Source Zones

Integrated Management Technology System for Autumn Inoculum Source Zones

Powder spraying technique for disease control in protected vegetables

【Led by Li Baoju, Institute of Vegetables and Flowers】

Addressing challenges in controlling high-humidity diseases in protected vegetable cultivation, the team spent 20 years developing a novel solution. The study was the first to demonstrate that aerosols are a major pathway for bacterial disease spread and clarified the transmission patterns of fungal pathogens. They replaced the traditional "daytime plant spraying" with an evening spatial powder-spraying method, developed a precision electric powder sprayer and new micro-powder formulations, and created the "Powder Spraying Technique for Disease Control in Protected Vegetables". This method requires no water mixing, overcomes the limitations of low-temperature/high-humidity conditions, shortens application time, reduces labor, enhances efficacy, and cuts chemical use. It is highly effective in the field against various vegetable diseases. The technique's core equipment was listed among the Major New Agricultural Equipment (2021) and recognized as a key promoted technology by the Ministry of Agriculture and Rural Affairs for two consecutive years. Widely recommended by provincial departments, it has become a leading solution in the vegetable disease control sector, with large-scale adoption nationwide.

Application of mist powder spraying technique in greenhouse cucumber production

Application of mist powder spraying technique in tomato arch-greenhouse cultivation

"Disruptive processing technology of plant-based meat" leads a new direction for the future food industry

【Led by Wang Qiang, Institute of Food Science and Technology】

Addressing the technical bottlenecks in high-moisture extrusion processing of plant-based meat, the team was the first to reveal how plant proteins form fiber structures resembling animal meat during extrusion. The research has been published in high-impact journals and was selected among the Top Ten Advances in Food Science and Technology in China. Wang's team overcame the barriers of equipment localization and achieved directional control of plant protein fibrous structure, simulating tensile strength of animal muscle fibers. They filed multiple invention patents, including the first U.S. invention patent for plant-based meat from China, and the technology was listed in several national innovation rankings. Wang's team established China's first kiloton-scale production line for high-moisture extruded plant-based meat, developed new products, participated in standard-setting, and successfully transferred the technology to multiple enterprises. It has been exhibited and promoted internationally and received the highest award of the International Academy of Food Science and Technology, earning broad recognition from global experts.

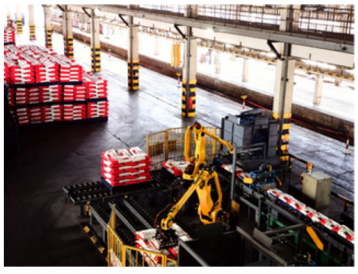
Production flowchart, product quality, and testing report of plant-based meat

Final food products made from plant-based meat produced via high-moisture extrusion

Green efficiency-enhancing technology for ammonium phosphate based on root–phosphorus synergy

【Led by Yuan Liang, Institute of Agricultural Resources and Regional Planning】

This achievement was recognized among the 2024 Major New Agricultural Technologies. Targeting low phosphorus fertilizer utilization, the team introduced the concept of "biological enhancement" and "signal-induced root phosphorus foraging", leading to a full-chain technological breakthrough for efficient phosphorus use and reduced application rates. The technology has been granted multiple invention patents, received an Excellent Patent Award, and supported the development of several national chemical industry standards and received preferential freight pricing. The value-added ammonium phosphate products based on this technology have been industrialized by leading fertilizer enterprises, achieving large-scale production and brand recognition. This innovation is driving the green transformation of the phosphorus fertilizer industry, enhancing sustainable resource utilization and promoting high-quality agricultural development.



Industrial application of green efficiency-enhancing technologies for phosphate-ammonium fertilizers

Promotion and application of new value-added phosphate-ammonium fertilizers

Green and efficient on-site processing technology for high-quality rapeseed oil

【Led by Huang Fenghong, Oil Crops Research Institute】

To overcome the challenges in rapeseed processing, the team developed a green and efficient on-site processing technology and integrated equipment, based on principles of "safety, nutrition, eco-friendliness, efficiency, and intelligence". Using high-quality rapeseed as raw material, they made breakthroughs in key technologies and equipment, setting a new direction for value-added rapeseed oil production. The technology has been widely demonstrated through multiple production lines across the country and has been recognized by academicians as internationally leading. It was included in State Council General Office policy documents, the agricultural machinery subsidy catalog, and the Major New Agricultural Technologies of China. The innovation improves the safety, nutrition, efficiency, and economic value of rapeseed oil processing, supporting consumption upgrades and promoting ecological agriculture and multi-level resource recycling. It plays an important role in rapeseed industry integration and the Healthy China strategy.

Demonstration production line for high-quality rapeseed oil processing 10 tons per day in Jingzhou, Hubei Province

7D high-quality rapeseed oil products produced by Hubei Zifubao Agricultural Development Co., Ltd.

"Three Guarantees" model: a science and technology-driven path to industrial support in poverty alleviation areas

【Led by Mao Shiping, Institute of Agricultural Economics and Development】

In alignment with China's innovation-driven development strategy, the team developed the "Three Guarantees" model to empower industrial support in formerly impoverished areas through agricultural science and technology innovation. Through nationwide surveys of key aided industries, they clarified constraints, assessed development challenges, and proposed a three-pronged approach: ensuring effective supply of agricultural technologies, ensuring effective extension, and ensuring effective transformation of research results. The findings were adopted in comprehensive internal reports by the General Office of the CPC Central Committee, applied in post-evaluation of poverty alleviation achievements, and received affirmative endorsement from central leadership. The model provided important scientific support for policymaking and implementation of targeted rural development initiatives.

Field survey on the development of agricultural mechanization in mountainous areas of Sichuan Province

03. Major Technological Tasks

Task 1 Breeding and Promotion of High-Oil, High-Yield Soybean Varieties

To address the national demand for edible oil security and improved soybean self-sufficiency, a major R&D task was launched to develop high-oil, high-yield soybean varieties. Targeting key challenges such as the lack of insect-resistant and herbicide-tolerant new varieties and insufficient advantages in basic high-oil soybean germplasm, a series of new transgenic materials resistant to lepidopteran pests and glyphosate, including Jingdou 625, were developed. Newly approved varieties include Zhongdou 72, with an oil content of 22.60%, protein content of 42.40%, and a 14.2% yield increase in regional trials, suitable for spring planting in Chongqing; and Zhongdou 51, with an oil content of 22.04%, protein content of 40.75%, and an 8.2% yield increase in regional trials, suitable for summer planting in the Yangtze River Basin.

High-oil, high-yield soybean variety Zhongdou 51

Transgenic soybean germplasm Jingdou 625 with resistance to lepidopteran pests and tolerance to glyphosate

Task 2 Development and Application of New Insect-Resistant, Stress-Tolerant, and High-Yielding Maize Varieties

To address the major national demand for enhanced maize productivity, CAAS launched a major technological task focused on developing and promoting new maize varieties with combined traits of insect resistance, herbicide tolerance, and stress tolerance. In response to the lack of new germplasm and varieties with stacked genes for multiple complex traits, the genetically modified insect-resistant and herbicide-tolerant maize line BBL2-2 was developed and granted a production and application safety certificate. Backbone varieties such as “Zhongdan 1130” and “Zhongdan 8921” were bred to suit different major maize-producing regions. Supporting cultivation techniques for these stress-tolerant, high-yielding varieties were established, with demonstration yields reaching an average of over 950 kg per mu (14.25 t/ha), achieving significant application results.

Zhongdan 1130 Maize

Transgenic maize line BBL2-2, granted a production and application safety certificate

Task 3 Breeding and Development of High-Yield, High-Quality, Stress-Resistant Rice Germplasm and Varieties

To address the national demand for enhanced rice productivity, CAAS launched a major technological task focused on developing new germplasm and varieties with high yield, superior quality, and multiple resistance traits. In response to the challenges of stagnant per-unit yield, low grain quality, and a lack of breakthrough varieties combining high yield, quality, stress tolerance, and disease resistance, the indica-japonica restorer line Zhonghui 575 with strong heterotic potential was developed. The long-grain indica-japonica hybrid rice variety Jiaheyou 175 achieved an average yield of 723.7 kg per mu (10.86 t/ha) over two years of regional trials, representing a 16.2% yield increase compared to the control Jiayou 5, with excellent grain quality and taste. It was awarded the Gold Prize in Taste Quality Evaluation (Japonica) at the 5th National High-Quality Rice Variety Competition. Huazheyou 210 received the Gold Prize in the Indica category and is expected to surpass 1 million mu (66,700 ha) in annual promotion within the next two years.

Jiaheyou 175 Rice

Huazheyou 210 Rice

Task 4 Development of Multiple-Cropping Rapeseed Varieties and Application of Efficient Production Technologies

Zhongyouzao No. 1 Rapeseed

To meet the national strategic demand for enhancing oilseed production and expanding rapeseed cultivation in fallow winter fields, CAAS launched a major technological task focused on developing new multiple-cropping rapeseed varieties and efficient production technologies. Addressing the key bottlenecks in the development of the multiple-cropping rapeseed industry, over 30 new breeding lines were developed with high yield, high oil content, multiple resistance traits, and short growth duration. Thirteen new hybrids performed well in early-maturing regional trials at the provincial level and above. The “rice–rice–rapeseed” annual efficient production model was optimized. The variety “Zhongyouzao No. 1” has a growth period of approximately 170 days and achieved a machine-harvested yield of 166.05 kg per mu (2.49 t/ha), 50.95% higher than that of the local leading variety, setting a new record for machine-harvested rapeseed yield in a triple-cropping system.

Task 5 Development of Breakthrough Diploid and Tetraploid Potato Germplasm and Varieties

To support national food security and diversified food supply, CAAS initiated a major technological task focused on the development of breakthrough diploid and tetraploid potato germplasm and new varieties. Addressing key constraints such as the narrow genetic background of tetraploid potatoes, outdated breeding technologies, the shortage of high-quality and stress-resistant germplasm, and the long-standing monopoly of processing-specific varieties by foreign entities, a dual-path strategy of "diploid hybrid breeding + precise tetraploid improvement" was implemented. The project designed an ideal potato haplotype and elucidated the genetic basis of heterosis in potatoes. A new hybrid combination, Youshu 1.1, featuring golden flesh, uniform tuber shape, and long-day tuberization, was developed with high dry matter and carotenoid content. Demonstration models for tetraploid potato industry applications showed remarkable results. The newly developed variety Zhongshu 27, suitable for both fresh consumption and frying, exhibited excellent appearance and resistance to soil-borne diseases. Field trials recorded a yield of 5,060 kg per mu (75.9 t/ha), representing a 4.3% increase over the control variety Lucinda.

Youshu 1.1: Compared to Youshu 1.0, this new hybrid exhibits a one-month longer dormancy period and a 30% increase in yield

Zhongshu 27: A newly developed potato variety suitable for both fresh consumption and frying

Task 6 Demonstration of Regional Improvement and Integrated Utilization of Saline-Alkali Land

In response to the national strategic demand to steadily expand agricultural production space and enhance overall agricultural productivity, CAAS launched the major technological task of "Demonstration of Regional Improvement and Integrated Utilization of Saline-Alkali Land". Targeting key bottlenecks such as limited technical reserves for saline-alkali land improvement in the Hetao region, lack of green and efficient soil and water treatment products, and insufficient integrated demonstration efforts, the initiative developed core technologies including intelligent blind-vertical-open drainage systems for salt discharge, straw interlayer barriers to reduce salinization, efficient salt leaching with water-fertilizer-agent mixtures, and multi-source water recycling. These innovations have led to the creation of the "Ordos Model" for water-saving, salt control, and ecological restoration of saline-alkali land. The model achieves over 30% savings in water and fertilizer use, reduces topsoil salinity by more than 20% on average, increases maize yield by over 15% in mildly saline areas, and boosts sunflower yield by 10%–30% in moderately to severely saline areas. To date, the total demonstration and application area has exceeded 2 million mu (133,000 ha).

(Left to right: Schematic of the 3D blind drainage and salt discharge system; saline-alkali land before and after treatment)
The "Ordos Model" for water conservation, salt control, and ecological restoration addresses key weaknesses of traditional hollow blind drainage systems—namely collapse risk, low durability, and unstable performance

Task 7 Research on Green and Efficient Key Technologies for Coupled Aflatoxin Control and Nitrogen Fixation in Soybean and Peanut

To address the national strategic demand for enhancing oil crop productivity and promoting green agricultural transformation, CAAS launched the major technological task of "Research on Green and Efficient Key Technologies for Coupled Aflatoxin Control and Nitrogen Fixation in Soybean and Peanut". This initiative targets the global challenges of high susceptibility of soybean and peanut to aflatoxin contamination—known for its extreme toxicity and strong carcinogenicity—as well as their naturally low nodule formation and limited yield potential. The project made breakthroughs in integrated technologies to enhance nodulation, nitrogen fixation, quality, and yield. A microbial inoculant (ARC agent) was developed and integrated with seed-fertilizer application, cultivation management, and storage classification practices. Demonstration trials at 230 sites across 17 provinces showed an average yield increase of 15.1% for soybean and 19.5% for peanut, with aflatoxin levels reduced by 69% and 80% respectively. The task successfully tackled the dual challenge of synchronously improving aflatoxin control and nitrogen fixation efficiency.

(Left: Conventional management; Right: ARC microbial inoculant treatment)
After application of the ARC microbial inoculant, the number of nodules, nodule weight, and nitrogenase activity in soybean root nodules increased by 2.33-fold, 3.52-fold, and 4.19-fold, respectively

Task 8 Research on Epidemic Patterns and Green Control Technologies for Wheat Basal Stem Rot

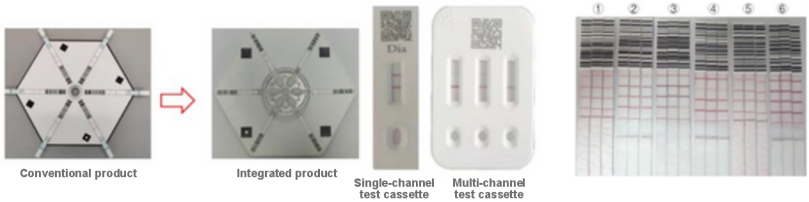
To address the demand for green prevention and control of sudden outbreaks of wheat basal stem rot, a major technological task titled "Research on Epidemic Patterns and Green Control Technologies for Wheat Basal Stem Rot" was launched. In response to challenges such as the lack of unified standards for resistance identification, outdated monitoring and early warning technologies, and the absence of specialized pesticides and application equipment, the project made key breakthroughs in pathogen identification, intelligent forecasting, and the full chain of prevention and control technologies; led the formulation of the industry standard Technical Specification for Evaluation of Wheat Resistance to Basal Stem Rot, providing technical support for resistance breeding; developed an intelligent disease forecasting device based on big data and machine learning, with an accuracy rate of up to 75%, filling the domestic gap in basal stem rot forecasting; created a specialized seed coating agent (imidacloprid·azoxystrobin·cyantraniliprole) that improves control efficacy by more than 20%, and initiated the registration process for this new pesticide formulation; developed supporting application equipment for efficient and precise target spraying; established a 2,000 mu (133.3 ha) core demonstration zone for integrated control technology, achieving a field control efficacy of up to 92%.

Specialized seed coating agent

Intelligent forecasting device for wheat basal stem rot

Task 9 Research and Demonstration of Key Green Control Technologies for Major Vegetable Pests and Diseases in Hainan

In response to the major public demand for safe and high-quality agricultural products, the major scientific and technological task "Research and Demonstration of Key Green Control Technologies for Major Vegetable Pests and Diseases in Hainan" was launched. Addressing challenges such as the difficulty in controlling thrips on cowpea, irregular pesticide use, and low throughput and accuracy in pesticide residue detection, the project adopted a dual-approach strategy: the development of multi-target test strips and the establishment of a cloud-based image recognition platform. Combined with a multi-channel intelligent support module and smart terminals, it enabled—for the first time—the simultaneous extraction and detection of 18 analytes from agricultural product matrices within 15 minutes, with accurate data interpretation and cloud uploading. A "three-in-one" green control technology system for cowpea pests, focused on pest control during flowering and integrating spraying, shaking, and suction, was developed. The control efficacy reached 85.69%, pesticide use was reduced by 60%–70%, and the pesticide residue pass rate reached 100%. The technology was selected by the Ministry of Agriculture and Rural Affairs as a safe and high-quality production model and was promoted nationwide.



New colloidal gold test strip detection product and mobile terminal–based multi-residue pesticide analysis

(From left to right: control area, demonstration area, comparison of control effects)
New "three-in-one" green control technology for major cowpea pests

Task 10 Promotion and Application of the New "Human Disease, Animal Prevention" Model for Brucellosis

In response to the national need for brucellosis prevention and control, a major scientific and technological task on the promotion and application of a new "human disease, animal prevention" model for brucellosis has been launched. Aiming at key problems such as insufficient prevention capacity in epidemic areas and poor compatibility between vaccines and testing methods, the task formulated region-specific and locally adapted immunization strategies. Using marker vaccines for cattle and sheep, traditional vaccines, and supporting diagnostic reagents, scientific efforts were carried out in detection, immunization, monitoring, and purification demonstrations, establishing and promoting the new "human disease, animal prevention" model for brucellosis. Demonstration sites for immunization and monitoring were set up in pastoral areas such as Inner Mongolia and Gansu. In total, 128 million doses of the novel marker vaccine for sheep (M5-90Δ26 strain) were applied. In 2024, the incidence of human brucellosis in Inner Mongolia decreased by 15.4% compared with the same period in 2023. This task provides a systematic solution for brucellosis prevention and control in China and plays a significant role in enhancing the country's brucellosis control capacity and public health level.

Live attenuated gene-deletion marker vaccine for Brucella (M5-90Δ26 strain)

Researchers administering conducted vaccine immunization in demonstration areas

Task 11 Research and Demonstration of Key Mechanization Technologies for Oilseed Crop Production

To address the major strategic challenge and industrial demand posed by insufficient growth duration of rapeseed in the rice–oilseed rotation regions of China—hindering expansion and yield improvement—the research team optimized and developed rotary tillage and trenching components to reduce energy consumption during land preparation, improved a multi-gear mechanical speed regulation system to achieve stable plant spacing adjustment, and refined depth-mimicking control. The finalized 2ZG-6 rapeseed transplanter can simultaneously perform multiple operations including rotary tillage with residue incorporation, trenching, soil leveling and slotting, clod cutting and transplanting, and soil covering and compaction under conditions of full straw return after rice harvest. The machine achieves an operation efficiency of 6 mu (0.4 ha) per hour, with a transplanting qualification rate of over 85%, significantly reducing labor and operational costs. The product has been licensed to Sinomach Changlin for production and marketing, and has been promoted and applied in Jiangxi, Jiangsu, Hunan, and Anhui and other provinces, helping to expand rapeseed cultivation in over 80,000 mu (5,333 ha) of idle winter fields, and has received widespread acclaim from users.

2ZG-6 Rapeseed Transplanter

Transplanting performance in winter fallow fields

Task 12 Research on High-Quality Development Pathways for Rural Specialty Industries

Focusing on the challenges of homogenization, low added value, and weak market competitiveness in China's rural specialty industries, four demonstration bases for high-quality development of rural specialty industries were established in Cangyuan (Yunnan), Hefeng and Wufeng (Hubei), and Yichuan (Henan). A regional *Apis cerana* honey production technology system was developed, and the signature "Cangyuan Black Honey" product was launched as a flagship "local specialty", increasing the income of 1,018 beekeeping households by over 8,000 RMB per household. An ecological and low-carbon tea production technology system was integrated and promoted over an area of 1,000 mu (66.7 ha), unlocking the value of ecological tea products and supporting tea farmers in mountainous areas to increase their income and achieve prosperity.

Apis cerana foraged on Mitrephora flowers in Cangyuan County

Demonstration of ecological and low-carbon tea production technologies in Wufeng County, Hubei

Task 13 Coordinated On-site Treatment and Utilization of Diverse Rural Waste

To address key challenges in rural areas-namely the small quantity, dispersed distribution, high treatment cost, and low harmlessness of household and production wast-this task innovatively developed a high-salinity-tolerant multifunctional fermentation-promoting microbial agent and integrated a high-efficiency decomposition process for organic solid waste. Key technological breakthroughs include salt-tolerant thermophilic functional microbes, intelligent multi-material compatibility, and efficient enzyme-assisted composting. These advances overcome limitations of traditional aerobic fermentation such as low degradation efficiency and prolonged composting cycles. The resulting coordinated and efficient fermentation model for rural organic solid waste provides strong support for improving rural living environments.

Composting equipment for rural waste

Composting and co-treatment equipment for diversified rural waste

SCIENCE AND TECHNOLOGY SUPPORT

- Expert Groups
- Demonstration of Integrated Technologies of High-Yield and High-Efficiency
- Rural Revitalization
- Cooperation with Enterprises
- Intellectual Property
- Research Layout

01. Expert Groups

Two technologies were selected as National Leading Agricultural Technologies of 2024. 19 dominant varieties and 25 key technologies were promoted to support the new initiative of increasing grain production capacity. A total of 18 expert groups dispatched 48 sci-tech service squads with nearly 2,000 person-times to 28 provinces and municipalities across the country, supporting the special grain production campaign and organizing over 1,000 technical training sessions, including "Field Classrooms".

Two technologies, including the ARC functional microbial inoculant for inducing efficient nodulation, nitrogen fixation, quality improvement, and yield increase in peanuts, were selected as National Leading Agricultural Technologies

A total of 19 varieties, including Zhongyouza 19, were selected as National Leading Varieties by the Ministry of Agriculture and Rural Affairs

The Wheat Expert Group organized " "Field Classrooms"

02. Demonstration of Integrated High-Yield and High-Efficiency Technologies

Demonstration field of precision regulation technology for high-density maize planting

Zhongmai 578 ranked the fourth nationwide in terms of annual planting area

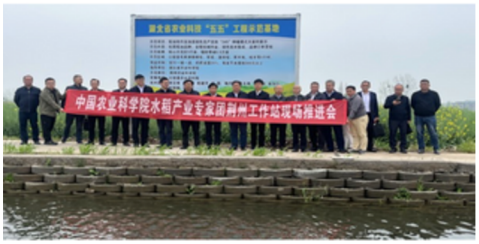
Stronger support was provided for ensuring stable agricultural production and supply. The high-yield technology for precision regulation of high-density maize planting was applied across more than 45 million mu (3,000,000 ha) in key producing provinces such as Xinjiang, Inner Mongolia, and Jilin. In a 100,000 mu demonstration zone in Yili, Xinjiang, yields increased by 21.5%. In the Huang-Huai-Hai region, despite unfavorable weather, summer maize achieved yields over one ton per mu (15 t/ha). The annual cultivation area of "Zhongmai 578" reached 9.42 million mu (628,000 ha), ranking the fourth nationwide. A 10,000 mu (667 ha) demonstration in Xingtai, Hebei set a new yield record for the dual-cropping region. Region-specific integrated control techniques for wheat stripe rust were promoted to safeguard yield on a large scale. A transboundary pest and disease prevention and control system was established to effectively curb the spread of migratory and epidemic pests and diseases to major grain-producing areas.

Region-Specific Integrated Control Technology for Wheat Stripe Rust ensures large-scale disease prevention and yield performance

03. Rural Revitalization

Empowering rural revitalization with stronger impacts. Achievements in science and technology support for rural revitalization were selected as typical cases by CCTV. Four practical outcomes—"CAAS Supports Stable Production and Supply to Safeguard the National Granary" "Technology Empowers Sheep Industry Development and Builds China's 'Sheep Valley' in Huan County" "Promoting the 'Ningling Spirit' to Support High-Quality Development of the Fruit Tree Industry", and "The 'All-Round High-Efficiency' Rapeseed Model Creates a New Prosperous Agro-Economy"-were selected as typical cases in the *CMG Rural Revitalization Observation Report 2023–2024*. Concentrated efforts were made to strengthen science and technology assistance. CAAS led 44 industrial advisory groups to conduct industrial planning, technical guidance, local talent training, and technology transfer. In the "Science and Technology Support for Counties" initiative: over 200 new staple crop varieties were tested and demonstrated, and 15 new technologies promoted in large-scale field trials in Huachuan, Heilongjiang; in Taijiang, Guizhou, the "Liwen Fragrant Rice" regional brand was developed, and industrial sour soup production technology successfully innovated to support the local Miao sour soup industry; in Zhouqu, Gansu, support was provided to help a honey product testing laboratory obtain dual certifications. Science and technology assistance to Xinjiang and Xizang continued to deepen. An integrated ultra-high-yield model for high-quality cotton achieved an average yield of 750.3 kg/mu (11.3 t/ha) in a 100-mu (6.7 ha) demonstration plot in the cool cotton-producing area of northern Xinjiang—a new yield record. Focusing on improving the dietary nutrition and health of Xizang residents, a nutritional quality analysis database for plateau-featured agricultural products was established. The local "Xiao Niujiao" chili pepper variety was purified and rejuvenated to support the high-quality development of agriculture in Xizang. Regional centers enhanced central–local coordination. Relying on regional centers, over 300 teams organized and secured nearly 200 research projects at various levels, promoting the integrated innovation and demonstration of advanced, applicable varieties, technologies, and equipment in major producing areas.

Four cases were selected as typical cases in the *CMG Rural Revitalization Observation Report 2023–2024*



18 expert groups and 44 advisory teams provided science and technology support for modern agriculture across the country

Delivering tailored science and technology support for major agricultural production counties

Prof. Yang Zhenhai unveiled the plaque for the sour soup testing laboratory in Taijiang

The integrated ultra-high-yield model for high-quality cotton set a new yield record

04. Cooperation with Enterprises

Strategic partnerships were established with enterprises such as Huawei and Syngenta, and a diversified innovation network was constructed and improved, involving research institutes, universities, leading enterprises, and other key innovation stakeholders. Annual cooperation projects with institute-level strategic partners such as CNADC, Dabeinong Group, and Rongtong Agricultural Development were promoted and implemented. Engagements and connections were carried out with nearly 200 enterprises, including leading companies such as Mengniu, China Railway Construction Corporation, and COFCO, as well as members of the science-industry integrated development consortium. Research institutes affiliated with CAAS provided services to over 2,300 agricultural enterprises, forming a comprehensive science-industry cooperation model encompassing customized R&D, joint research initiatives, platform co-construction, talent co-cultivation, and service empowerment. A conference on promoting large-scale yield improvement of grain and cotton in Xinjiang through science-industry integration was held, and an initiative for promoting large-scale yield improvement of grain and cotton in Xinjiang through science-industry integration was launched.

A working conference on promoting large-scale yield improvement of grain and cotton through science institution-enterprise partnership was held in Xinjiang

05. Intellectual Property

CAAS Intellectual Property Highlights Event

Efforts were made to strengthen intellectual property (IP) protection and efficient commercialization, fostering leading agricultural sci-tech enterprises, and promote the integration of scientific and industrial innovation. The quality of research output was improved, and high-value IP was used as a bridge to facilitate CAAS-enterprise cooperation. The overall IP commercialization rate of CAAS reached 27.7%.

06. Research Layout

The management and institutional layout of CAAS research institutes were further optimized. In accordance with the central government's mandate to streamline the positioning and layout of national research institutions, a proposal was developed to improve the overall configuration of CAAS scientific resources. Significant progress was made in enhancing research capacity planning in key provinces and municipalities. High-quality innovation and development plans were formulated for Beijing, Henan, Shandong, Heilongjiang, Xinjiang, and Inner Mongolia. Among them, the High-Quality Innovation and Development Plan of CAAS in Henan Province (2024—2035) was jointly issued with the People's Government of Henan Province. The conceptual master plan and construction proposal for the CAAS Graduate School Zhengzhou Campus were completed with high standards. The proposal was reviewed and approved at a special meeting of the CPC Henan Provincial Committee, with a preliminary investment scale estimated at 7 billion RMB and a planned total floor area of nearly 1 million m^2, laying a solid foundation for the long-term development of the future CAAS University.

Construction of major scientific research platforms:

Systematic operation of major research platforms was strengthened. A total of 1.05 billion RMB in construction funding was secured throughout the year. Eight national key laboratories led by CAAS officially commenced operation. In key areas such as seed technology and biosafety, facilities for the preservation of germplasm resources—including oil crops, forage grasses, medicinal plants in northern China, sika deer, and Mongolian cattle—were improved. A major platform for phenotypic identification of crops in the Nanfan region began trial operations. The resource preservation and innovative utilization systems for crops and livestock were further enhanced. The Chengdu Center Vertical Farming Industry Demonstration Base was fully completed. Trial station capacities in Dezhou, Shunyi, and Shaerqin were continuously upgraded, providing effective support for scientific research and integrated technological innovation. Experimental infrastructure for migratory insect studies on Changdao Island and quarantine facilities for imported crop varieties were also established to enhance biosafety research capabilities.

Layout of major scientific research facilities:

CAAS advanced the systematic construction of major scientific platforms, significantly strengthening core capacities for achieving scientific and technological self-reliance. The National Phenotypic Identification Research Facility, the National Seed Industry Innovation Center, and the Northern Rice Research Center were completed and put into operation. The Agricultural Genomics Research Center was fully completed, and construction of the Northwest Center of the National Agricultural Biosafety Science Center accelerated. The main structure of Phase I research buildings at the Anyang Innovation Base was topped out. Construction of the National Germplasm Bank for Livestock and Poultry completed its underground structure; the Nanfan International Cooperation and Exchange Center is about to commence construction; feasibility studies for the Nanfan International Cooperation and Exchange Center is about to commence construction; feasibility studies for the National Soil Sample Repository, the National Plant Biosafety Resource Preservation and Utilization Facility, and the National Agricultural Microbial Resource Bank have been submitted to the Ministry of Agriculture and Rural Affairs for review. A phased advancement model of "projects completed, under construction, and planned" has been formed.

The National Phenotypic Identification Research Facility is a flagship initiative supporting the construction of the Nanfan Silicon Valley. Targeting crops such as rice, maize, and cotton, the facility focuses on major scientific questions related to crop phenotypic interaction mechanisms and theoretical research under field and controlled environments. It aims to build a high-throughput, multi-environment, multidimensional, full-growth-cycle platform for large-scale, precise identification of phenotypes and genotypes, significantly boosting China's independent innovation in elite germplasm creation, key gene discovery, and major variety development. The total construction area is 46,000m^2, with supporting field-based phenotyping facilities and large-scale validation zones. It is located in Sanya, Hainan Province.

The National Phenotypic Identification Research Facility in Sanya

Northern Rice Research Center is a national-level science and technology innovation platform established in Northeast China as part of China's strategic agricultural research layout. It represents a key deployment by CAAS to advance the development of the rice industry in northern regions. Aligned with the country's major food security strategy, the Center focuses on six core research areas: innovation of rice germplasm resources, new variety breeding, physiological and ecological studies, cultivation technology development, soil fertility improvement, and remediation. It also carries out research on common and key technologies critical to the development of the northern rice industry, contributing to industrial upgrading and quality-efficiency improvement. The Center occupies a total area of 411 mu (27.4 ha) and is located in Baoqing, Heilongjiang Province.

Northern Rice Research Center

The National Seed Industry Innovation Center focuses on crops, livestock and poultry, and agricultural microorganisms. It builds upon the achievements of upstream major platforms related to germplasm resources, fundamental theories, and phenotyping studies, while prioritizing breeding technology innovation, variety development, seed propagation and processing, and industrial incubation in the mid-to-late stages of seed industry innovation. The center deeply integrates germplasm and information resources to build a stronghold for basic research in biological breeding and strategic variety development. It supports the development of the Nanfan Silicon Valley, the National Tropical Agriculture Science Center, and the Hainan Free Trade Port. The total floor area is 50,000m², and it is located in Sanya, Hainan Province.

National Seed Industry Innovation Center

The Agricultural Genomics Research Center is a concrete initiative by CAAS to implement the development strategy of the Guangdong-Hong Kong-Macao Greater Bay Area. Targeting major national needs such as food security, biosafety, and ecological security, the center focuses on fundamental research guided by genomics, including big data biology and synthetic biology. It aims to make breakthroughs in key scientific and frontier technologies such as complex genome analysis, whole-genome design breeding, synthetic genomes, and artificial chromosomes. The center promotes interdisciplinary integration between genomics and fields such as agriculture and food, and aspires to become a strategic scientific infrastructure in China's genomics research. The total floor area is 35,000m², and it is located in Shenzhen, Guangdong Province.

Agricultural Genomics Research Center

The Northwest Center of the National Agricultural Biosafety Science Center serves as a key initiative for CAAS to implement its "Academy-wide Support for Xinjiang" strategy. The center is designed to address major scientific and technological challenges in the characteristic oasis agriculture of western China and to meet the critical needs of agricultural production and industrial development in the region. It aims to become a pilot zone for innovation-driven development with concentrated high-end resources and significant innovative capacity. The center will establish an innovation support system for key and common technologies across four major agricultural industry clusters: grain and oil crops, cotton and textiles, green organic fruits and vegetables, and high-quality livestock products. It will also serve as a strategic barrier safeguarding northwestern China from invasive alien species. The total floor area is 12,000m², and it is located in Changji Hui Autonomous Prefecture, Xinjiang Uygur Autonomous Region.

The sketch of Northwest Center of National Agricultural Biosecurity Science Center

The Anyang Innovation Base represents a major strategic initiative by CAAS to advance coordinated development in the Greater Beijing Area. It serves as a comprehensive research platform and cluster of major facilities located outside Beijing. The base extends the disciplinary strengths of CAAS in areas such as crop science, plant protection, and animal husbandry, while also establishing full-industry-chain R&D platforms for key regional industries including wheat, maize, oil crops, pigs, and broiler chickens. Designed under a "one core, two wings, and multiple nodes" framework, the base aims to become a top-tier hub for agricultural science and technology innovation, a demonstration zone for rural revitalization, and a center for agricultural civilization promotion—supporting high-quality development of agriculture and rural areas both regionally and nationally. Phase I of the project covers a total floor area of 80,000m² and is located in Anyang, Henan Province.

The sketch of Anyang Innovation Base Phase I

The National Livestock Gene Bank is a key initiative to advance the strategic conservation of China's livestock and poultry germplasm resources. It integrates ultra-low temperature cryopreservation with innovation in monitoring and early warning technologies, while connecting with breeding introduction bases, regional gene banks, conservation farms, and protected areas. The bank

establishes an efficient system combining in vivo conservation with genetic material preservation, serving as the "foundation" and "core" of the national livestock and poultry germplasm resource conservation system. It supports livestock and poultry breeding, basic research, industrial development, and international competitiveness, and is set to become a innovation center for germplasm resources. The facility covers a total floor area of 14,000m^2 and is located in Beijing.

The sketch of National Livestock Gene Bank

The Nanfan International Cooperation and Exchange Center is a key project launched by CAAS to support the construction of the Nanfan Silicon Valley and establish an international platform for cooperation and exchange. Focusing on major scientific and technological issues in national food security and seed industry innovation, the center leverages the policy, resource, and geographical advantages of the Hainan Free Trade Port. It promotes international collaboration in areas such as germplasm discovery and utilization, and biological breeding under the Belt and Road Initiative framework. The project aims to build a new breeding network for Nanfan crops that integrates China's agricultural science and technology innovation with a shared future for global agricultural production. The facility has a total floor area of 6,300m^2 and is located in Sanya, Hainan Province.

The sketch of Nanfan International Cooperation and Exchange Center

The National Agricultural Microbial Germplasm Resource Bank is committed to becoming China's "Noah's Ark" for the conservation and utilization of agricultural microbial germplasm resources. It is designed to achieve diversified collection, large-scale preservation, systematic conservation methods, modern infrastructure, and intelligent management. The facility will have the capacity to preserve 200,000 strains and 5 million samples, including microbial strains, DNA, and biological specimens. It will support precise identification and systematic evaluation of microbial resources, meeting China's strategic needs for microbial germplasm conservation, basic research, industrial application, and enhancing international competitiveness for the next 50 years. With a total floor area of 12,000m^2, the facility is located in Tongzhou District, Beijing.

The sketch of National Agricultural Microbial Germplasm Resource Bank

The National Major Scientific Research Facility for the Conservation and Utilization of Plant Biosecurity Resources aims to establish a domestically leading and internationally advanced national platform that integrates the collection and preservation of plant biosecurity resources, fundamental theoretical innovation, breakthroughs in bottleneck technologies, and high-level talent cultivation. The facility will support systematic collection, diversified preservation, and intelligent management of plant biosecurity resources. It will be capable of conserving 245,000 accessions of live specimens, herbarium samples, and seeds, along with one million DNA/RNA genetic resource samples, thereby meeting China's strategic needs in plant biosecurity-related basic research, technological development, and long-term resource reserves over the next 50 years. With a total construction area of 18,900m^2, the facility will be located in Changping District, Beijing.

The sketch of National Major Scientific Research Facility for the Conservation and Utilization of Plant Biosecurity Resources

The National Digital Collaborative Innovation Platform for Agricultural and Rural Development aims to build a new type of data-intensive platform to support the fourth paradigm of agricultural science research, featuring open scientific collaboration, autonomous and secure infrastructure, and pervasive sustainability. It will establish a resource-efficient, highly integrated, and flexible computing system with a storage capacity of 10 PB and a computing capacity of 20 PFlops, supported by high-performance computing clusters (HPC clusters). The platform focuses on developing general-purpose algorithms for agricultural science and enabling scenario-based applications, facilitating intelligent and professional academic search and knowledge discovery in agriculture. The project will provide comprehensive support in terms of "data, algorithms, and computing power" for agricultural scientific research. The major construction tasks include procuring software and hardware infrastructure, conducting system development and integration. The platform is located in Haidian District, Beijing.

KEY INITIATIVES

- **Scientific and Technological Innovation Project**
- **Strategy for International Cooperation and Development**
- **Talent Pool**

01. Scientific and Technological Innovation Project

The implementation of the Agricultural Science and Technology Innovation Program (ASTIP) was further advanced in 2024. The construction of science centers continued to progress, with a total of 11 centers established and 22 key scientific tasks newly selected and launched. Strong support was provided to major scientific and technological tasks, with 13 new tasks added during the year. The program continued to support the development of young leading talents, providing research funding for 448 outstanding scientists. A mid-term evaluation of the ASTIP Leap-forward Phase was organized. Multilevel evaluations were conducted, including internal assessments of research teams by institutes, self-evaluations by research institutes, and institutional evaluations by CAAS headquarters, covering 36 affiliated institutes and 330 research teams. A systematic review was carried out on the implementation progress and fund utilization efficiency of the Program during 2021–2023, identifying weaknesses and gaps. Based on the findings, optimization plans were proposed to adjust research teams and institutional structures. Efforts were made to further align with the "Four Orientations" strategic requirement. The development directions of research institutes were refined, and resources were focused to promote the output of major scientific achievements. The top-level design and strategic planning of the next phase of ASTIP were accelerated, aiming to leverage CAAS's institutional and organizational advantages, launch new science and technology initiatives, and enhance the organized agricultural innovation system. The goal is to address critical scientific problems of overarching and long-term significance to China's agricultural and rural development.

Mid-term evaluation meeting of the ASTIP Leap-forward Phase

02. Strategy for International Cooperation and Development

Engaging in Global Food and Agriculture Governance and Supporting China's Overall Diplomatic Strategy

CAAS played a leading role in agricultural S&T cooperation under multilateral and bilateral frameworks such as the G20 Meeting of Agricultural Chief Scientists (MACS), the China-EU dialogue on agri-food science and technology cooperation, etc. It coordinated and advanced the comprehensive partnership with CGIAR, and actively participated in negotiations and rule-making processes related to climate change, pesticides, veterinary drugs, soil health, food safety, and agri-product quality standards. China-Africa Agricultural Science and Technology Innovation Alliance (CAASTIA) was launched and incorporated into the deliverables of President Xi Jinping's visit to Africa and the Forum on China-Africa Cooperation (FOCAC) Beijing Action Plan (2025–2027). In 2024, CAAS hosted 5 state leaders and 32 ministerial-level delegations.

Mr. Gaston Browne, Prime Minister of Antigua and Barbuda and his delegation visited CAAS

CAAS and the African Academy of Sciences (AAS) jointly launched CAASTIA at the opening ceremony of the 2024 China-Africa Innovation Cooperation and Development Forum

Progress in G2P International Mega Science Project

The G2P (From Genome to Phenome-Deciphering Crop Genetic Resources) International Mega Science Project, initiated and led by CAAS, received high-level attention from central leadership, the Ministry of Science and Technology, and the Ministry of Agriculture and Rural Affairs. The pilot project passed the final acceptance review and was formally concluded. The Project has gained strong recognition and support from international partners such as FAO and the Bill & Melinda Gates Foundation.

The First Plenary Meeting of the Governing Board of G2P International Mega Science Project

Actively Promoting Agricultural S&T Going Global

The regional control approach for fall armyworm was awarded the 2024 FAO Achievement Award

Experts from the China National Rice Research Institute (CNRRI), CAAS, carried out CAASTIP II in Kenya

The cross-border pest monitoring technologies and integrated control solutions were awarded the "Special Contribution Award" by the Ministry of Agriculture and Forestry of Laos. The regional control approach for fall armyworm was adopted and promoted by the FAO, and received the 2024 FAO Achievement Award. Organized and implemented Phase II of the International Science & Technology Innovation Program of Chinese Academy of Agricultural Sciences (CAASTIP II), with a focus on key areas such as animal disease prevention and control, transboundary pest and disease control, and crop breeding. The program promoted the transfer and application of technologies and products beyond national borders, engaged both domestic and international enterprises, and deployed full agri-food value chains in partner countries. Four cases of CAAS were recognized as Best Poverty Reduction Cases in the Fifth Global Solicitation for Best Poverty Reduction Practices recognized by the United Nations' specialized agencies.


第五届全球减贫案例征集活动

证 书

中国农业科学院国际合作局：

贵机构提交的《中非芝麻科技合作助力减贫发展——中国农业科学院多方合作案例》荣获"第五届全球减贫案例征集活动"最佳减贫案例，并将收录进南南合作减贫知识分享网站——中外减贫案例库及在线分享平台。

特发此证，以资鼓励。

The China-Africa Sesame Technology Collaboration for Poverty Alleviation and Development, recommended by the Oil Crops Research Institute of CAAS, was recognized as one of the Best Poverty Reduction Cases

Balanced efforts in talent introduction and cultivation built up an internationalized talent pool

Throughout the year, CAAS hosted 173 visits by foreign senior experts. It now holds the full-time appointment of Dr. Felix Dakora-the former President of the African Academy of Sciences and Foreign Member of the Chinese Academy of Engineering-as a Senior Advisor. Two experts received China's highest honor for foreign professionals, the "Friendship Award". As of now, a total of 16 international experts collaborating with CAAS have received this prestigious award. Seventeen Distinguished Young Scholars from seven developing countries conducted academic exchanges at 12 research institutes of CAAS. CAAS organized 32 international training seminars throughout the year, including four ministerial-level seminars, facilitating high-level dialogue under the South-South Cooperation framework.

Dr. Felix Dakora, the former President of the African Academy of Sciences and a Foreign Member of the Chinese Academy of Engineering, was recruited as a full-time Senior Advisor of CAAS

A total of 106 experts from CAAS held senior management positions in international academic organizations and global governance mechanisms, while 358 experts served as editorial board members for 710 renowned international journals. There are six agricultural diplomats assigned to Chinese embassies, consulates, and permanent missions abroad, and six scientists working at international organizations such as FAO. A total of 9 projects were successfully approved under the Chinese Government Scholarship (CGS) programs administered by the China Scholarship Council (CSC) for senior visiting scholars, visiting scholars, and postdoctoral fellows. Additionally, 34 scholarships were granted under the CSC High-Level University Graduate Program, placing CAAS among the top agricultural research institutions in terms of the approval rate. Over the year, CAAS sent 515 missions abroad involving 1,084 personnel, and received 546 international visitors.

Ms. Shen Yiqin, State Councilor of China presented the Chinese Government Friendship Award to two foreign senior experts recommended by CAAS

CAAS hosted the Ministerial Workshop on Digital Agriculture and Rural Revitalization for BRI Partner Countries

03. Talent Pool

Talent Program

The high-level talent team continued to expand. In 2024, 55 new high-caliber talents were added, including one Fellow of the African Academy of Sciences and one National Science Fund for Distinguished Young Scholars recipient, both recruited on a full-time basis, as well as six young talents brought in through national special programs. One researcher received the Guanghua Engineering Science and Technology Award, another won the Ho Leung Ho Lee Foundation Award for Scientific and Technological Progress, and a third one was honored with the Science Exploration Award. A total of 446 new senior professional titles were granted.

The CAAS Talent Program was upgraded and optimized. The evaluation mechanism was refined, and 37 new scientific talents were selected. Dynamic performance evaluation at the end of the support period was strengthened, bringing the total number of awardees under the program to 477.

Comprehensive support was provided for the development of young researchers. In 2024, 24 members of the Young Scientists Program advanced to the CAAS-level Talent Program, and 7 were selected into national-level talent initiatives. The Young Talent Mentorship Program was launched, establishing 312 mentor-mentee pairs in key fields to support the professional development of young researchers during their golden period of growth. Meanwhile, the Young Talent Global Fellowship Program continued, sending 17 young talents to world-class universities for academic exchange and training.

The reform of the talent evaluation mechanism was deepened. Top-level design for talent evaluation was enhanced, and an implementation plan was issued to promote the reform of the categorized evaluation mechanism. Over 80 reform measures were proposed, focusing on the full cycle of talent evaluation. The evaluation system for the CAAS Talent Program was optimized to strengthen mission orientation and establish a multidimensional, integrated assessment framework that covers theoretical innovation, technological breakthroughs, product development, and market application-fostering integrated development across industrial and disciplinary chains.

Graduate Education

CAAS has 5 A+ disciplines: Crop Science, Horticulture, Plant Protection, Animal Husbandry, and Veterinary Medicine;

CAAS held a Working Conference on Graduate Education

2 A disciplines: Biology and Agricultural Resources and Environment; and 2 A-disciplines: Ecology and Food Science and Engineering. The Master of Agricultural Professional Degree is rated A. CAAS has 1,040 doctoral supervisors and 1,771 master's supervisors.

A Strong Start for the China Graduate School of Modern Agriculture. An additional 169 PhD and 130 master's degree quotas were granted by the Ministry of Education, reaching a record high with a total enrollment of 2,177. Five academic divisions were established along with an Education Steering Committee. High-level inter-university teaching teams and joint advisory groups were formed, and 100 high-quality courses were co-developed.

Four new degree programs were approved with a 100% success rate: a PhD program in Food Science and Engineering, a Doctor of Agriculture degree, and master's programs in Meteorology and Food and Nutrition. This marked full coverage of PhD authorizations across 11 major disciplinary clusters. A collaborative mechanism aligned with major national agricultural S&T tasks was implemented, with 80% of doctoral dissertations based on national research projects. One doctoral dissertation was awarded the 2024 Excellent Doctoral Dissertation of Beijing, and another was nominated. All 56 master's theses sampled in the 2021–2022 Beijing region quality review were rated "Good" or above. One professional master's thesis was selected as a national exemplary case for agricultural master's degrees. CAAS students achieved outstanding results in national competitions, including the China Graduate Rural Revitalization Science and Technology Innovation Competition, the National Postgraduate Mathematical Modeling Contest, and the 2nd Innovation and Entrepreneurship Competition for Professional Veterinary Degree Postgraduates.

In 2024, 110 international students were newly admitted, bringing the total to 295 from 46 countries. The scale of PhD international students ranks among the top in domestic universities. A total of 50 international students graduated, including 45 PhDs and 5 master's students. Nine international alumni ambassadors were appointed. One supervisor was named a "Star Supervisor" under the 2024 "Perceive China" initiative by the China Scholarship Council. CAAS successfully passed the re-certification for the quality of higher education for international students in China, with the final report recognizing CAAS as an industry leader in international education and research in agricultural science. A total of 40 PhD students were enrolled under Chinese-foreign joint education programs in 2024, with students from overseas universities, domestic Double First-Class universities, and CAAS accounting for 80% in the China-Belgium program and 85% in the China-Netherlands program. Students published high-level articles in Nature and Nature Genetics, and achieved a 97.1% employment rate after graduation. CAAS also became one of the 17 founding members of the Global PhD Platform for Food, Conservation, and Care.

Review for the re-accreditation of higher education quality for international students in China

International students visited the dual-purpose medicinal and edible plant experimental greenhouse

Postdoctoral Work

Pilot projects on pre-employment selection for postdoctoral researchers were launched to establish a mechanism for early identification and targeted support, aiming to attract and retain more outstanding postdoctoral talent. The number of postdoctoral researchers exceeded 900, ranking first among agricultural and forestry universities and research institutes nationwide. The funding from the China Postdoctoral Science Foundation increased by 7% year-on-year, and three new postdoctoral innovation practice bases were established.

APPENDIX

- Organizational Structure of CAAS
- Annual Budget and Staff
- Disciplinary System

Organizational Structure of CAAS

President

Secretary of Leading Party Group

Vice-Presidents

Administrative Departments

- General Office
- Department of Research Management
- Department of Personnel
- Department of Finance
- Department of Development and Construction
- Department of International Cooperation
- Department of Technology Transfer
- Department of Major R&D Programs
- CAAS Party Committee
- Department of Supervision

- Graduate School of CAAS
- China Agricultural Science and Technology Press Co., Ltd.

Research Institutes in Beijing

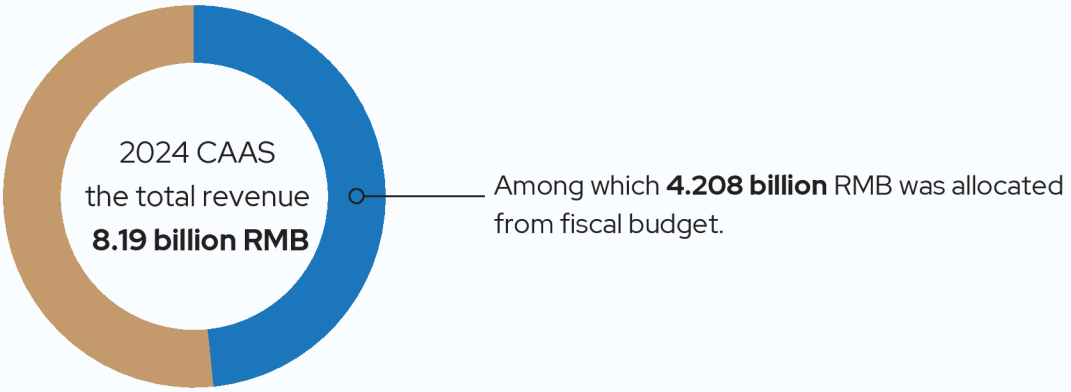
- Institute of Crop Sciences
- Institute of Plant Protection
- Institute of Vegetables and Flowers
- Institute of Environment and Sustainable Development in Agricultural
- Institute of Animal Sciences
- Institute of Apicultural Research
- Institute of Feed Research
- Institute of Food Science and Technology
- Biotechnology Research Institute
- Institute of Agricultural Economics and Development
- Institute of Agricultural Resources and Regional Planning
- Agricultural Information Institute
- Institute of Quality Standards and Testing Technology for Agro-Products
- Institute of Food and Nutrition Development of MARA

Research Institutes outside Beijing

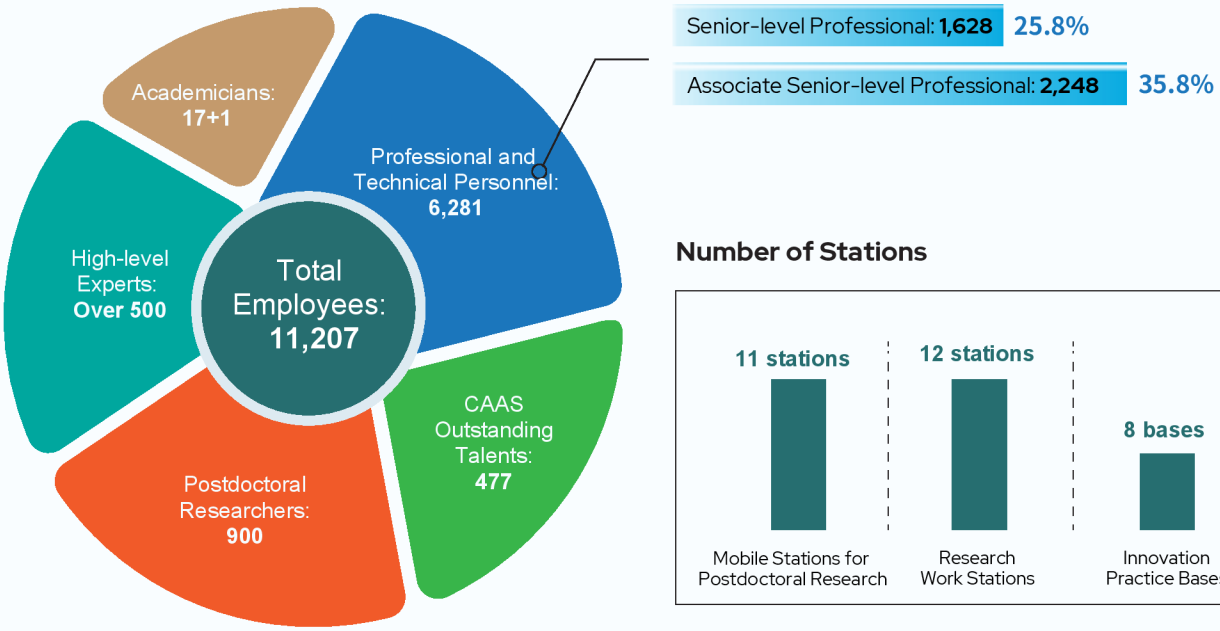
- Institute of Farmland Irrigation
- China National Rice Research Institute
- Institute of Cotton Research
- Oil Crops Research Institute
- Institute of Bast Fiber Crops
- Institute of Pomology
- Zhengzhou Fruit Research Institute
- Tea Research Institute
- Harbin Veterinary Research Institute
- Lanzhou Veterinary Research Institute
- Lanzhou Institute of Husbandry and Pharmaceutical Sciences
- Shanghai Veterinary Research Institute
- Institute of Grassland Research
- Institute of Special Animal and Plant Sciences
- Agro-Environmental Protection Institute of MARA
- Biogas Institute of MARA
- Nanjing Institute of Agricultural Mechanization of MARA
- Institute of Tobacco Research
- Agricultural Genomes Institute at Shenzhen
- Institute of Urban Agriculture

Annual Budget and Staff

In 2024, the total revenue of CAAS reached RMB 8.19 billion, of which RMB 4.208 billion came from government appropriations. Among the appropriations, RMB 1.446 billion was allocated to institute-coordinated research projects, accounting for 34.36% of the total government funding.



CAAS currently has 11,207 staff members, including 6,670 on the official payroll. The number of professional and technical personnel stands at 6,281, among whom 1,618 hold senior titles and 2,248 hold associate senior titles, accounting for 25.8% and 35.8% of the total respectively. The Academy is home to 17 Academicians of the Chinese Academy of Sciences and the Chinese Academy of Engineering, plus 1 foreign Academician, and over 500 high-level experts. The "ASTIP Talent Program" supports 477 talents. CAAS hosts 11 mobile postdoctoral stations, 12 postdoctoral research work stations, and 8 innovation practice bases.



Disciplinary System

The disciplinary system has become more robust. Focusing on basic and frontier research as well as key areas, CAAS strengthened disciplinary development and further advanced the strategic layout of disciplines such as Agricultural Microbiology, Biosecurity, Rural Development, and Rural Energy. A three-tier disciplinary system has been established comprising 11 major disciplinary clusters, 58 disciplinary fields, and 283 key research directions.

Brief table of disciplinary setting of CAAS (2024)

Cluster of Disciplines (11)	Academic Field (58)	Major Direction (283)
Agricultural Basic and Frontier Sciences	4 Academic Fields: Frontier Technologies, etc.	26 Key Directions: Gene Editing Technologies, etc.
Crop Science	5 Academic Fields: Crop Germplasm Resources, etc.	47 Key Directions: Collection and Conservation of Crop Germplasm Resources, etc.
Horticulture	4 Academic Fields: Genetic Breeding of Horticultural Crops, etc.	20 Key Directions: Vegetable Genetic Breeding, etc.
Plant Protection	6 Academic Fields: Crop Diseases, etc.	19 Key Directions: Monitoring and Control of Grain Crop Disease Epidemics, etc.
Agricultural Resources and Environment	6 Academic Fields: Cultivated Land and Soil, etc.	22 Key Directions: Soil Fertilization and Improvement, etc.
Animal Science	5 Academic Fields: Animal Genetics and Breeding, etc.	27 Key Directions: Genetic Breeding of Pigs, etc.
Veterinary Medicine	6 Academic Fields: Animal Diseases, etc.	21 Key Directions: Avian Diseases, etc.
Agricultural Microbiology	4 Academic Fields: Ecology and Function of Agricultural Microorganisms, etc.	16 Key Directions: Growth-Promoting Microorganisms for Crops, etc.
Agro-product Quality and Processing	5 Academic Fields: Quality and Safety Control of Agro-products, etc.	25 Key Directions: Quality and Safety Control of Grain, etc.
Agricultural Equipment Engineering and Information	6 Academic Fields: Agricultural Machinery and Equipment, etc.	25 Key Directions: Planting Machinery, etc.
Agricultural Economics and Rural Development	7 Academic Fields: Agricultural Economics, etc.	35 Key Directions: Agricultural Technology Economics Theory, etc.

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